An online exploration of Arizona's biotic communities and their animals

Where the Wild Things Are

LESSON OVERVIEW

Students, working in small groups, are given three maps (topographical, precipitation, and vegetative) and asked to find correlations. Using an online resource focusing on the biotic communities of Arizona, students will check these correlations and explain how plants are distributed through Arizona. Based on this information, the groups ask a question and develop a hypothesis related to how animals are distributed in Arizona. They will use additional online resources to support or refute their hypothesis and present their findings to the class.

SUGGESTED GRADE LEVELS

- 9 – 12

ENDURING UNDERSTANDINGS

- A number of characteristics, including elevation and climate, are used to divide Arizona into regions called biotic communities.
- Because of its diverse range of elevations, Arizona has numerous biotic communities and tremendous natural diversity.
- Each biotic community in Arizona has unique plants and animals that are adapted to survive in that particular environment.
- Maps come in various types, including thematic (rainfall, population, vegetation) and topographic.

OBJECTIVES

Students will:

- Explain how climate affects the distribution of animals throughout Arizona.
- Use a variety of maps (i.e., topographical, precipitation, etc.) to determine the effects of climate on plant distribution in Arizona.
- Use online resources to plan and solve a question related to the distribution of animals in Arizona.
- Use Excel spreadsheets to organize and analyze data from an investigation.

ARIZONA DEPARTMENT OF EDUCATION STANDARDS

Grade	Science	Technology
High School	S1-C1-01; S1-C1-02; S1-C1-03; S1-C1-04; S1-C2-04; S1-C2-05; S1-C3-02; S1-C3-07; S1-C4-01; S1-C4-02; S1-C4-03; S1-C4-04; S4-C3-01; S4-C3-02	3T-P2-02; 3T-P2-03; 4T-P2-01

Note: The full text of these standards can be found in Appendix A.

An online exploration of Arizona's biotic communities and their animals

TIME FRAME

- 9 days (45 minutes each day)

MATERIALS

- *Biotic Communities Map of Arizona* (one per group)
- *Arizona Topography Map* (one per group)
- *Average Annual Precipitation Map* (one per group)
- *Map of Arizona: Student Version* (one per group)
- *Biotic Communities Rubric* (one per group)
- *Poster Rubric* (one per group)
- *Poster Analysis Worksheet* (one per student)
- Computers with Internet access

TEACHER PREPARATION

- Review "Exploring Arizona's Natural Resources" and the World Wildlife Fund "WildFinder" Web sites prior to class.
- Be sure computers with Internet access are available.
- Decide on groupings for student teams. Four is the recommended number in a group. It is best to use heterogeneous teams.
- Make copies of the *Biotic Communities Map of Arizona, Arizona Topography Map, Average Annual Precipitation Map, Map of Arizona: Student Version, Mapping Biotic Communities Rubric* and *Poster Rubric* for each group.
- Make copies of the *Poster Analysis Worksheet* for each student.

SUGGESTED PROCEDURES

Day 1:

1. Divide the class into groups of 3–4 students. Try to put students of varying ability levels into groups.
2. Give each group a copy of the *Biotic Communities Map of Arizona*.
3. Inform the students that scientists have divided Arizona into separate and distinct biotic communities. These communities are differentiated by the kinds of plants that grow in them.
4. Ask the class: Why would the communities each have different kinds of plants growing in them? Solicit responses from the students. Write this question as well as their answers on the board. If they have not mentioned climate, be sure to get this one on the board.
5. Explain that each of the ideas they have generated is a hypothesis, or a scientist's guess to the answer. In order to determine if this hypothesis might be true, scientists need to do an experiment or test. For the sake of time, we are going to consider only one hypothesis — climate.
6. Ask the class: If we want to test this hypothesis, what do we need to do? Solicit responses from the students. If they have not done so on their own, guide them to the idea that we would need to look at the climate in these areas to see if it is different from area to area.

7. Explain that you have some maps that will help in understanding the climate of Arizona. One is a precipitation map and the other is a topographical map. Why would a topographical map be important? Help the students understand that the temperature (which is a factor in climate) usually gets colder as you move up in elevation.
8. Inform the students that before we can actually begin this experiment, we need to clarify our hypothesis. The easiest way to do this is to write it in a format known as: *If...and...then*. In this format, we write our hypothesis after the "if," our test after the "and," and our predicted outcome after the "then." As a class, guide the students through the development of our hypothesis statement. For example:

   ***IF** the biotic communities of Arizona are formed because of differences in climate, **AND** we look at topographical and precipitation maps of Arizona, **THEN** we should see similar biotic communities occurring at locations that have similar elevations and rainfall.*

9. Give each group a copy of the topographical and precipitation maps of Arizona. They are to use the maps to determine if the evidence supports our hypothesis.
10. Explain that each group must come up with a simple conclusion that follows the hypothesis statement. It can be in the form of either "*and...therefore...*" or "*but...therefore...*" depending on whether the hypothesis is supported or refuted. For example:

    Hypothesis
    ***IF** the biotic communities of Arizona are formed because of differences in climate, **AND** we look at topographical and precipitation maps of Arizona, **THEN** we should see similar biotic communities occurring at locations that have similar rainfall and elevations.*

    Possible Conclusions
    ***AND** the biotic communities did occur at locations that have similar climate conditions **THEREFORE** there are correlations between climate and vegetation.*
    or
    ***BUT** the biotic communities occurred at locations with different climate conditions **THEREFORE** there is no correlation between climate and vegetation.*

Day 2:

1. Review the question and activities from the previous session.
2. Ask each group to share their conclusion statements. When all groups have finished, discuss and compare the results from the groups. Were they same? What does this tell us about the plants in Arizona? Were they different? Why might different groups have gotten different results with the same data?
3. Explain that although there could be other explanations, scientists have used the data to determine that these biotic communities are largely created by differences in climate.

4. Assign each group to a computer and help them access "Exploring Arizona's Natural Resources" from the Arizona Game and Fish Web site.
5. Give each group a copy of the *Map of Arizona: Student Version*.
6. Explain that they are to read the descriptions of the biotic communities and use this information, along with the precipitation and topographical maps from the previous session, to draw in the biotic communities on the map of Arizona. Each biotic community should be a different color and the map should include a key. They must use the *Mapping Biotic Communities Rubric* to assist them in preparing their maps.
7. When all groups have finished their maps, they are to compare them to the *Biotic Communities* map they were given during the previous session. As a class, discuss the similarities and differences. If both maps contain the same information, why might there be differences?
8. Collect the student-drawn biotic communities maps and use the rubric to assess.

Day 3:

1. Ask students to explain the factors involved in the distribution of plants in the state of Arizona. They should focus on their knowledge from the previous days involving climate, particularly rainfall and elevation.
2. Ask the class: if plants are distributed in a logical manner, is the same true for animals? Would they be influenced by climate? By plants? Are all types of animals influenced in the same way?
3. Inform the students that they will have the opportunity to explore the idea of animal distribution in Arizona. As a group, they must decide on a question related to this topic. Then, they must develop a hypothesis statement using the format described previously. Explain that they will be conducting Internet research to answer this question, collecting data to support their conclusion, and presenting this information to the class in the form of a poster.
4. Before they can develop this question and hypothesis, however, they must become familiar with the technique they will be using to find the data. If possible, use a teacher computer along with a projector to expose the students to the "WildFinder" Web site. Guide them through the various tools on the Web site, particularly how to determine the types and numbers of animals found in the various regions of Arizona. If this is not possible, you may need to help the groups access and navigate the Web site on their own computers.
5. Give the groups a few minutes to develop a question. They must obtain your approval of their question and hypothesis before you allow them to proceed.
6. When you have approved their question and hypothesis statement, allow them to access the Web site (and others if you deem necessary and appropriate) to test their hypothesis. Be sure to point out that the table of animals from the Web site can be copied and pasted into an Excel document. This allows easy manipulation of the data.

Day 4:

1. Even though groups may still be researching, this is a good time to review the criteria for the poster. Hand out the *Poster Rubric* and go over the criteria with the students. Answer any questions. Explain that in a few days (you must determine the appropriate time frame) the class will be holding a research

poster session, like scientists do. Each group will display their poster, and classmates (as well as any other school or community members you would like to invite) will tour the displays, stopping at each poster to listen to an explanation of the research.

2. Allow the students more time to research and develop their posters.

Days 5 – 8:

1. Allow the students more time to research and develop their posters.

Day 9:

1. Give each group the opportunity to set up their poster around the room. This works really well in a large room like the gymnasium.
2. Give each student a copy of the *Poster Analysis Worksheet*. Instruct them that each student is expected to review three posters.
3. Divide each group into two smaller groups, A and B.
4. During the first half of the period, all of the A groups are to visit the other posters while all of the B groups stay behind to explain the research. At the appropriate time, the groups will switch places to allow each person to see the projects.
5. When the poster session has ended, the groups must hand in their posters and the individuals must hand in their poster reviews.
6. Use the *Poster Rubric* to assess the posters.

ASSESSMENT

- Biotic communities maps assessed with *Biotic Communities Rubric*
- Posters assessed with the *Poster Rubric*
- *Poster Analysis Worksheets*
- Informal discussions

EXTENSIONS

- Encourage students to conduct a Web search to find information on the differences in the criteria used by various scientific fields to define or delineate biotic communities. For example, do plant biologists (botanists) and animal biologists (zoologists) use the same or different criteria to designate biotic communities?
- Students can research animals that are found in only one biome and identify adaptations that allow them to survive.
- Students might write a more formal research paper using endnotes and a list of works cited.
- Students could share their displays at an Open House or Parent Night.
- Students could share displays with a class of fourth graders who have been studying Arizona.

Appendix A: Arizona Department of Education Standards – Full Text

Science Standards

Grade	Strand	Concept	Performance Objective
High School	1	1 – Observations, Questions, and Hypotheses	1 – Evaluate scientific information for relevance to a given problem 2 – Develop questions from observations that transition into testable hypotheses 3 – Formulate a testable hypothesis 4 – Predict the outcome of an investigation based on prior evidence, probability, and/or modeling (not guessing or inferring)
		2 – Scientific Testing (Investigating and Modeling)	4 – Conduct a scientific investigation that is based on a research design 5 – Record observations, notes, sketches, questions, and ideas using tools such as journals, charts, graphs, and computers
		3 – Analysis, Conclusions, and Refinement	2 – Evaluate whether investigational data support or do not support the proposed hypothesis 7 – Propose further investigations based on the findings of a conducted investigation
		4 – Communication	1 – For a specific investigation, choose an appropriate method for communicating the results 2 – Produce graphs that communicate data 3 – Communicate results clearly and logically 4 – Support conclusions with logical scientific arguments
	4	3 – Interdependence of Organisms	1 – Identify the relationships among organisms within populations, communities, ecosystems, and biomes 2 – Describe how organisms are influenced by a particular combination of biotic (living) and abiotic (nonliving) factors in an environment

Technology Standards

Grade	Strand	Concept	Performance Objective
High School	3	2 – Use a variety of technology tools for data collection and analysis to support a decisions	2 – Create and use a spreadsheet to analyze variables (e.g., 12-month budget, loan rates, science and math experiments, and investment portfolios)

Technology Standards Continued

Grade	Strand	Concept	Performance Objective
High School	3	2 – Use a variety of technology tools for data collection and analysis to support a decisions	3 – Analyze data and create a database report from information manipulated in a variety of ways to support decisions (e.g., census data, polls and surveys, annual report)
	4	2 – Manage and communicate personal and professional information utilizing technology tools and resources	1 – Plan and present a product appropriate to the task.

Appendix B: Worksheets and Overheads

The pages that follow contain the worksheets listed below:

A. *Biotic Communities Map of Arizona* – A map showing the size and locations of the various communities in Arizona (1 page)

B. *Arizona Topography Map* – A shaded relief map showing elevations throughout the state (1 page)

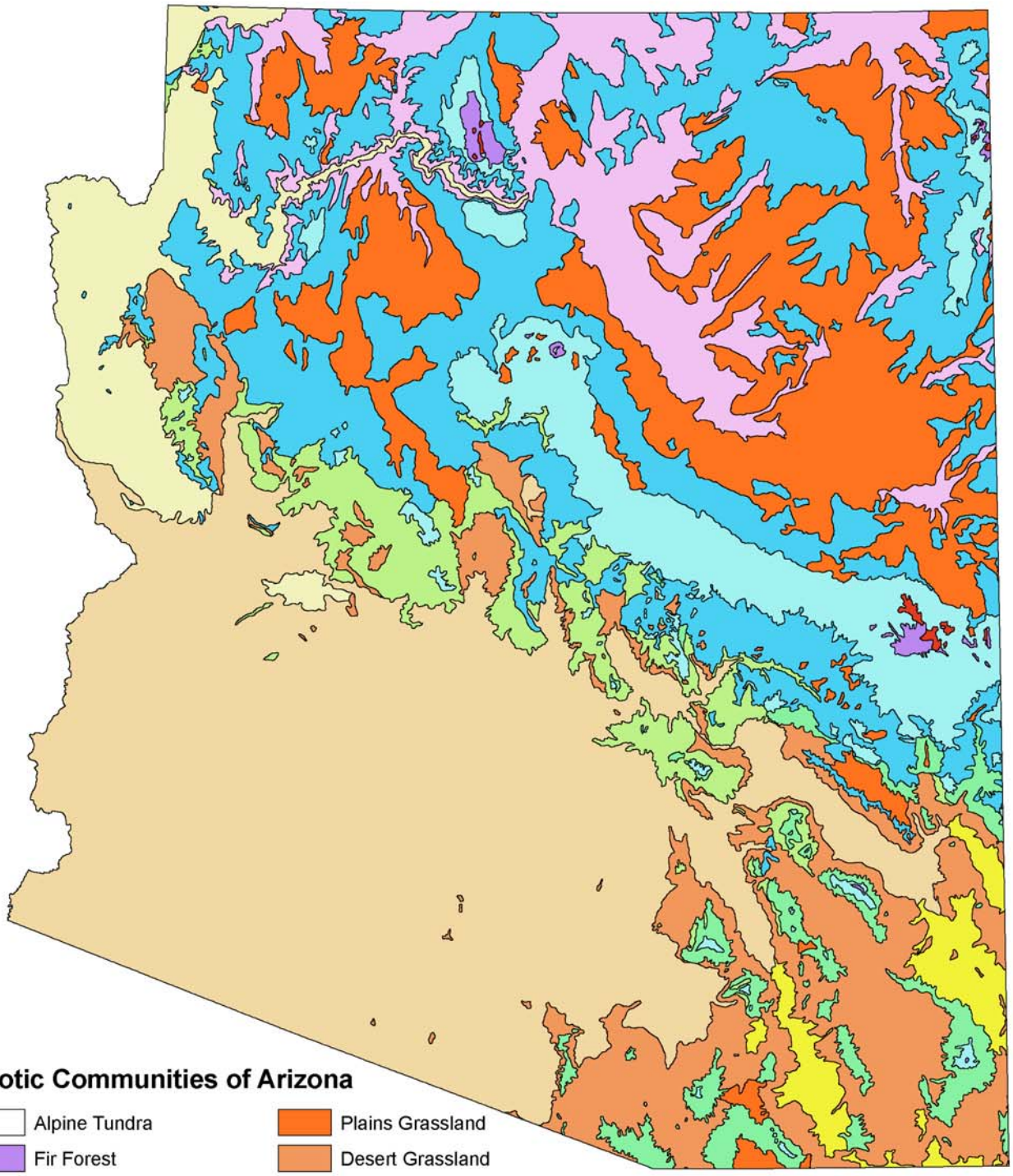
C. *Average Annual Precipitation Map* – A map showing the average precipitation that areas of Arizona receive each year (1 page)

D. *Map of Arizona: Student Version* – A blank map that the students can use to map the biotic communities (1 page)

E. *Mapping Biotic Communities Rubric* – One possible method for assessing the student-generated maps (1 page)

F. *Poster Rubric* – One possible method for assessing the group posters (1 page)

G. *Poster Analysis Worksheet* – A student form to evaluate posters (1 page)



Biotic Communities of Arizona

- Alpine Tundra
- Fir Forest
- Pine Forest
- Pinyon - Juniper
- Oak Woodland / Oak - Pine
- Chaparral
- Mountain Grassland
- Plains Grassland
- Desert Grassland
- Great Basin Desert
- Mohave Desert
- Chihuahuan Desert
- Sonoran Desert

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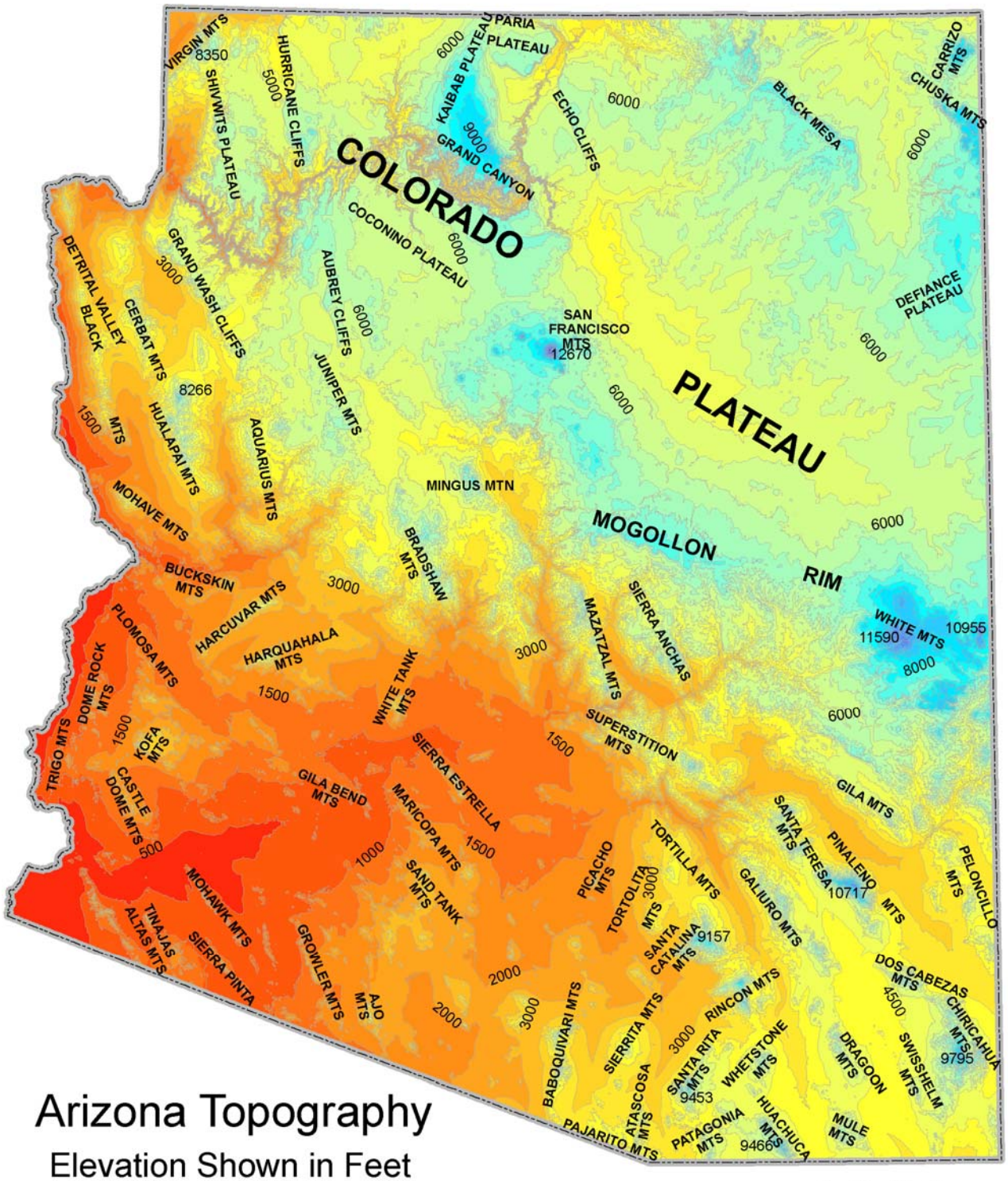
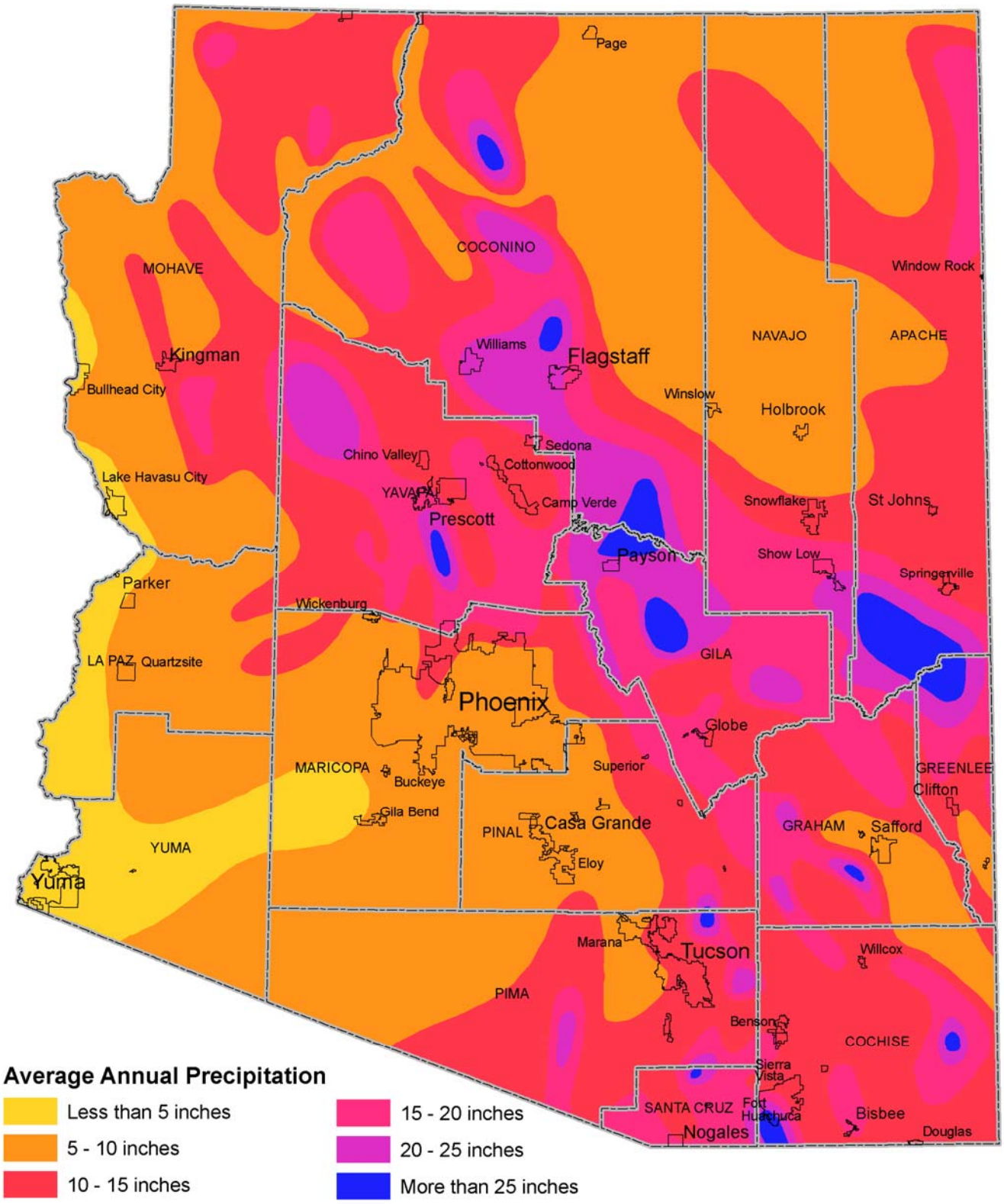
Adapted from "Biotic Communities of the Southwest", August 1980 by David E. Brown and Charles H. Lowe.



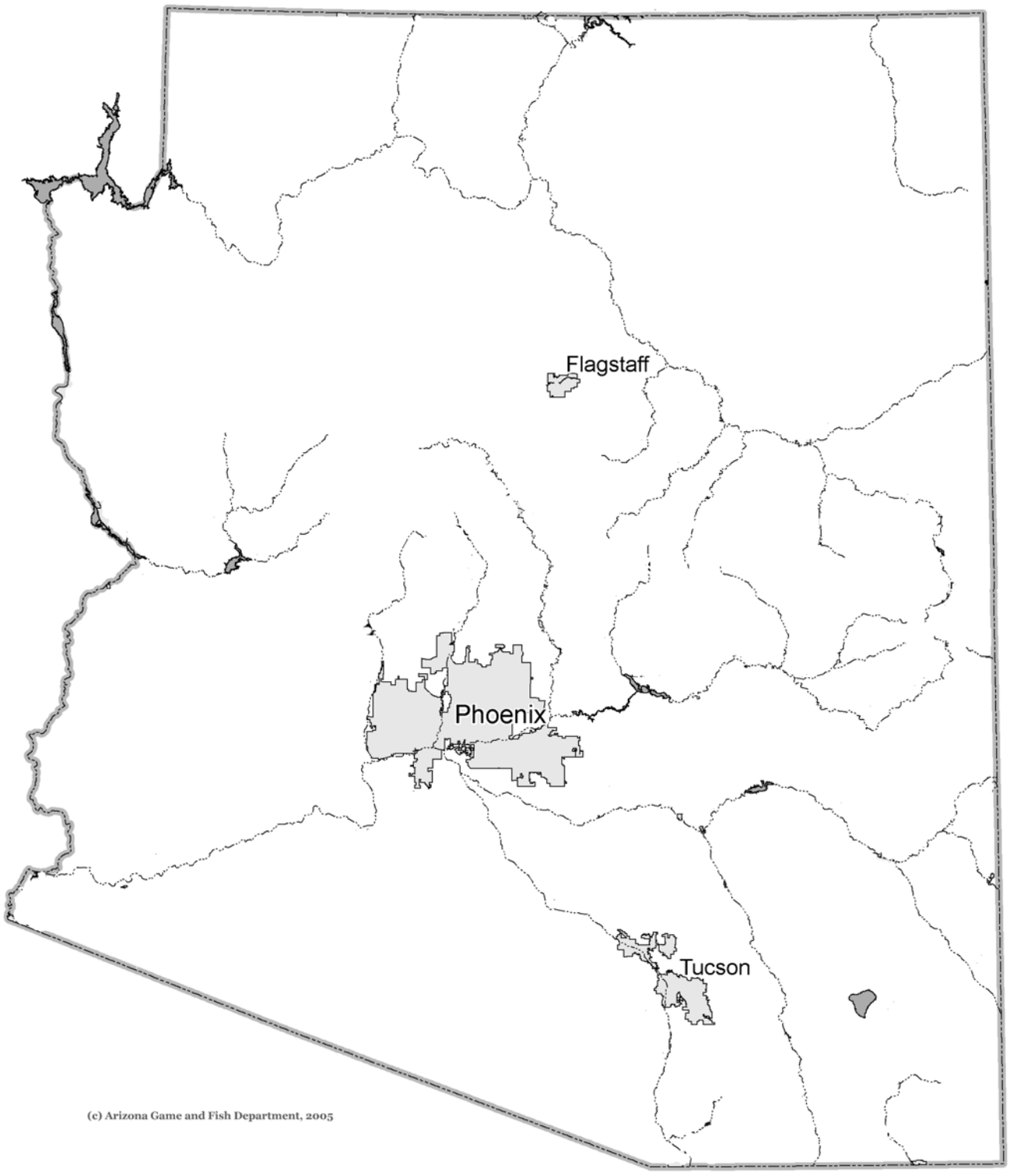
Arizona Topography

Elevation Shown in Feet

0 - 500
500 - 1000
1000 - 1500
1500 - 2000
2000 - 2500
2500 - 3000
3000 - 3500
3500 - 4000
4000 - 4500
4500 - 5000
5000 - 5500
5500 - 6000
6000 - 6500
6500 7000
7000 - 7500
7500 - 8000
8000 - 8500
8500 - 9000
9000 - 9500
9500 - 10000
10000 - 10500
10500 - 11000
11000 - 11500
11500 - 12000
12000 PLUS



Map of Arizona: Student Version



Where the Wild Things Are

Mapping Biotic Communities Rubric

Use the following rubric to assist you as you create your map of the biotic communities in Arizona.

CATEGORY	4	3	2	1
Labels - Accuracy	Items are labeled and located correctly.	Most items are labeled and located correctly.	Some items are labeled and located correctly.	Many items are labeled and located incorrectly.
Labels and Features - Neatness	Labels/ features can be read easily and are neatly done.	Most labels/ features can be read easily and are neatly done.	Labels/ features may be difficult to read and/or are messy.	Labels/ features are difficult to read and/or are messy.
Map Legend/Key	Legend is easy-to-find and contains a complete set of symbols, including a compass rose.	Legend contains a complete set of symbols, including a compass rose.	Legend contains an almost complete set of symbols, including a compass rose.	Legend is absent or lacks several symbols.
Spelling/ Capitalization	Words on the map are spelled and capitalized correctly.	There are few spelling or capitalization errors.	Many words are misspelled and/or are capitalized incorrectly.	Most words are misspelled and/or are capitalized incorrectly.

Where the Wild Things Are

Poster Rubric

Use the following rubric to assist you in creating your poster for this activity.

CATEGORY	4	3	2	1
Labels/Title	All major sections are clearly labeled and can be read from at least 3 feet away.	Almost all major sections are clearly labeled and can be read from at least 3 feet away.	Some of the major sections are clearly labeled and can be read from at least 3 feet away.	Labels are too small to view or no major sections were labeled.
Question	The question is clearly defined and stated.	The question is identified but is stated in a somewhat unclear manner.	The question is partially identified and is stated in a somewhat unclear manner.	The question is irrelevant or not present.
Hypothesis	Hypothesis is clearly written in the correct format and reasonable based on prior knowledge.	Hypothesis is clearly written and based on prior knowledge.	Hypothesis is difficult to understand and is not based on prior knowledge.	The hypothesis is not present.
Data/Analysis	Graphs and tables are neat, labeled, and titled. Trends and patterns are identified and logically analyzed.	Graphs and tables are neat, labeled, and titled. Trends and patterns are identified.	Graphs and tables are present and may be labeled, but there is no analysis.	Graphs and tables are not present.
Conclusion	Conclusion includes all elements (hypothesis has been supported or refuted, what was learned, and questions for future study).	Conclusion is missing 1 element.	Conclusion is missing 2 elements.	Conclusion is not present.
Appearance	Poster is typed and pleasing to the eye. All information is organized in a clear, logical manner. All graphics are relevant.	Poster is typed and pleasing to the eye. Information is organized in a clear, logical manner. Some graphics are not relevant.	Information is organized in a somewhat logical manner. Some graphics are not relevant.	Information is not organized in a logical manner. Graphics are not present or not relevant.
Spelling/ Grammar	There are no spelling or grammar mistakes on the poster.	There is 1 spelling or grammar mistake on the poster.	There are 2 spelling or grammar mistakes on the poster.	There are more than 2 spelling or grammar mistakes on the poster.

Poster Analysis Worksheet

Group Members: ____

Thoroughness of hypothesis	4	3	2	1
Comments:				
Quality of graphs	4	3	2	1
Comments:				
Validity of Conclusions	4	3	2	1
Comments:				
Attractiveness of Poster	4	3	2	1
Comments:				
Quality of presentation	4	3	2	1
Comments:				

What did you like about the poster and presentation?

Suggest improvements for the presenters.

What did you learn from this presentation?

Group Members: ____

Thoroughness of hypothesis	4	3	2	1
Comments:				
Quality of graphs	4	3	2	1
Comments:				
Validity of Conclusions	4	3	2	1
Comments:				
Attractiveness of Poster	4	3	2	1
Comments:				
Quality of presentation	4	3	2	1
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Attractiveness of Poster	4	3	2	1
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Quality of presentation	4	3	2	1
Comments:				

What did you like about the poster and presentation?

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